REMARKS:

Applicant has carefully studied the nonfinal Examiner's Action and all references cited therein. The amendment appearing above and these explanatory remarks are believed to be fully responsive to the Action. Accordingly, this important patent application is now believed to be in condition for allowance.

Applicant responds to the outstanding Action by centered headings that correspond to the centered headings employed by the Office, to ensure full response on the merits to each finding of the Office.

Claim Objections

Claim 39 stands objected to for improper dependency upon claim 40. Claim 39 has been amended to be properly dependent upon Claim 34.

Claim Rejections – 35 U.S.C. § 103

Applicant acknowledges the quotation of 35 U.S.C § 103(a).

Claims 1, 7, 8, 12-16, 27, 29, 30, 34, 37, 39 and 40 stand rejected under 35 U.S.C § 103(a) as being unpatentable over Zhu (5,192,865), in view of Slivon et al. (4,982,097).

Regarding independent Claim 1, the Office contends that Zhu teaches a mass spectrometer comprising a watertight case having an inlet, a means for transforming a solution into ions, a means for directing the fluid to the transferring means, and a quadrupole mass filter for analyzing the gas-phase molecules. The Office further states that while Zhu does not explicitly specify transformation into a gas phase, it is known in the art that liquid chromatography systems transfer solutions (liquids) into a gas as taught by Slivon et al. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to transform from a solution phase into a gas phase because it is the underlying requirement of liquid chromatography systems. The Office further contends that it is known that

these systems need to operate in a watertight case to achieve optimum results, and, because of this characteristic, it can easily operate in any type of environment. The claims have been amended to better reflect that which the Applicant regards as the present invention. As such, Applicant respectfully traverses the finding of the Office.

Independent Claim 1 has been amended to more clearly claim the present invention as disclosed. The present invention is adapted to provide for in-situ analysis of a fluid sample obtained from an aqueous environment. As described at pg. 3, lines 3-12, the present invention address the challenges faced in creating an underwater mass spectrometry system. These challenges include, performing mass spectrometry in a vacuum, and transporting analytes from an aqueous environment into a vacuum system, underwater.

In addressing the necessity of performing mass spectrometry in a vacuum, the present invention provides a watertight case that serves to enclose all of the components of the mass spectrometer analysis system. These components include the introduction means for the fluid sample, the means for transforming the analyte molecule from a liquid phase into a gas phase, the mass spectrometer itself and the pumping system. It is known in the art that the operation of mass spectrometers requires that the mass spectrometer be enclosed in a housing enabling control of the vacuum conditions that exist at the mass spectrometer interface. Maintenance of a vacuum inside the mass spectrometer housing requires continuous pumping due to gas loads from fluid sample introduction and outgassing from the walls of the mass spectrometer vacuum housing. As described at pg. 10, lines 11-14, the vacuum housing for the mass filter 11 is designed to ensure that compounds entering the vacuum system from the membrane pass through the quadrupole-mass-filter electron-impact ionization source before diffusing into the vacuum chamber. As such, the present invention provides a watertight case that encloses all of the components of the mass spectrometer analysis system, and a second case that encloses the mass spectrometer within the watertight case. The pumping system of the present invention serves to provide the required vacuum to the mass spectrometer housing enclosure, not to the watertight case. As shown in Fig. 1, the diaphragm pumps 20 and 21, and the drag pump 19 are in fluid communication with the mass filter spectrometer housing 11. And as is described at pg. 11, lines 1-3, the vacuum in the quadrupole-mass-filter housing is provided by a turbo-molecular drag pump 19 backed by two diaphragm pumps 20 and 21. Typical operation of roughing pumps

allows them to exhaust at atmospheric pressure. If the pressure at the exhaust port is significantly greater than 1 atm, the pumping efficiency goes down, and in some cases the pumps do not work at all. This situation presents a concern for operation in an enclosed watertight case that is submerged in water at higher than atmospheric pressure. The roughing pumps of the present invention exhaust into the watertight case and the pressure in the case due to the exhaust of the pumps does increase during operation of the analysis system. However, as disclosed at pg. 15, lines 3-17, the watertight case allows for the evacuation of the pressure vessel prior to submerging the system allowing the operation of the system for an extended period of time.

In addressing the need to transport analytes from an aqueous environment into a vacuum system, underwater, the present invention provides a fluid control system. As described at pg. 10, lines 12-19, the fluid control system of the present invention is used to alternatively direct deionized water and sample water to the membrane interface, comprises a peristaltic pump 16 and a two-position six-port rotary switching valve. The peristaltic pump 16 is used to direct both deionized water and sample water through the system at a nominal rate. While a plurality of embodiments of the fluid control system are presented by the present invention, to include bladders and sample loops, as described at pg. 12, lines 11-23 and pg. 13, lines 1-7, sampling of the water column underwater establishes a high pressure condition that poses a potential problem for the membrane introduction interface. Diffusion rates across the membrane depend on the pressure gradient thereacross, and there is a possibility of rupturing the membrane at higher pressures. The plurality of embodiments of the fluid control system of the present invention are adapted to provide a means of acquiring a fluid sample from an aqueous environment for introduction into a watertight case under the increased pressure experienced in an underwater environment.

By contrast, Zhu does not describe a mass spectrometer analysis system adapted to provide in-situ analysis in an aqueous environment as claimed by the present invention. Zhu does not describe a watertight case that serves to enclose all of the components of the mass spectrometer analysis system. The Office states that it is known that these systems need to operate in a watertight case to achieve optimum results, and, because of this characteristic, it can easily operate in any type of environment. The watertight case referred to by the Office is the spectrometer housing in which it is know to create a vacuum for optimum performance of the

spectrometer. However, Zhu does not describe a watertight case that would allow the introduction of a mass spectrometer analysis system into an aqueous environment. As previously stated, the requirements for successful underwater deployment include control of the fluid sample introduction under pressure and maintenance of a vacuum to the spectrometer housing under pressure. Claim 1 has been amended to include the limitation of a fluid control system whereby the fluid samples of the present invention are acquired from an aqueous environment. Claim 1 has also been amended to include a mass analyzer housing adapted to enclose the mass spectrometer and a pumping system adapted to provide a vacuum to the mass spectrometer housing.

The Office combines the teaching of Zhu and Silvon to describe the means for transforming the analyte molecule from a liquid phase into a gas phase as taught by the present invention. The Office states that it is known in the art that liquid chromatography systems transfer solutions into a gas phase and that Silvon describes at col. 1, lines 32-46, the underlying requirement of most LC/MS techniques is to transform the liquid HPLC eluent, consisting of solvent and chromatographically separated solute, into the gas phase, and that this transformation is necessary in order to separate the solvent from the analytically important solute, or to use the solvent vapor in order to ionize the solute, and in most cases, accommodate the vacuum requirements of the mass spectrometer. The Office concludes that it would have been obvious to one of ordinary skill in the art at the time the invention was made to transform from a solution phase to a gas phase because it is the underlying requirement of a liquid chromatography system. However, the present invention does not disclose or claim a liquid chromatography system. Claim 1, as amended, claims the transformation of analyte molecules of a fluid sample acquired from an aqueous environment from a liquid phase into a gas phase. The present invention states at pg. 22, lines 10-11 that the membrane interface is attached to the vacuum housing at the location normally occupied by a gas chromatograph transfer line. Therefore, it is clear that the membrane interface is not equivalent to the gas chromatograph described by the prior art. Silvon describes a liquid chromatography system that is not equivalent to the transformation as claimed by the present invention, and as such teaches away from the present invention as claimed.

For the reasons cited above, Applicant believes that amended independent Claim 1 is patentable over Zhu in view of Silvon and is believed to be in condition for allowance.

Claims 2-16 are dependent upon Claim 1, and are therefore allowable as a matter of law.

Regarding amended, independent, Claim 24, the present invention discloses and claims the steps of acquiring a fluid sample from an aqueous environment and delivering the fluid into a substantially fluid-tight case through a sample inlet. Neither Zhu nor Chiang describe the steps of acquiring a fluid sample from an aqueous environment and delivering the fluid into a substantially fluid-tight case through a sample inlet, but instead describe the introduction of a gas phase sample into a mass spectrometer which is known to be in a vacuum. As such, independent Claim 24 is obvious over Zhu, alone or in combination with Chiang.

For the reasons cited above, Applicant believes that currently amended independent Claim 24 is patentable over Zhu in view of Chiang and is believed to be in condition for allowance.

Claims 25-16 are dependent upon Claim 1, and are therefore allowable as a matter of law.

Regarding independent Claim 34, for the reasons cited above with regard to Claim 1 and Claim 24, Applicant believes that currently amended independent Claim 34 in patentable over Zhu in view of Chiang and is believe to be in condition for allowance.

Claims 35-41 are dependent upon Claim 34, and are therefore allowable as a matter of law.

Claims 2, 3, 5, 6, 17, 19, 20, 25, 28, 35, 38, 42, 44, and 45 stand rejected under 35 U.S.C § 103(a) as being unpatentable over Zhu (5,192,865), in view of Slivon et al. (4,982,097), and further in view of Chiang (6,100,522).

Regarding independent Claim 17, the Office states that it is obvious that the prior art makes use of a selective transport means, but this means is not explicitly depicted between the introduction and analyzing means. The Office goes on the state that Chiang teaches a selective transport means (56 and 58) that is between the directing means (28) and the analyzing means (30) at col. 3, lines 3-33 and with reference to Fig. 1. The Office concludes that it would have been obvious to one of ordinary skill in the art at the time the invention was made to sue this selective transport means because it will ensure the proper pressure and prevent an undesirable

increase. The Applicant respectfully traverses the finding of the Office regarding the selective transport means as disclosed and claimed by the present invention.

Claim 17 of the present invention includes the limitation of a transforming means comprising an introduction probe comprising a membrane having selective transport properties. With reference to Fig. 1 of Chiang, element 56 represents a pulse damper and element 58 represents a column such as a chromatograph column. While Chiang does describe at col. 3, lines 3-33 a means by which the back pressure regulator prevents an undesirable increase in pressure at the outlet of the chromatograph, this is not equivalent to the introduction probe comprising a membrane having selective transport properties as claimed by the present invention.

Additionally, neither Zhu, Silvon or Chiang, alone or in combination teach a substantially fluid-tight fluid control pressure vessel, a substantially fluid-tight mass spectrometer pressure vessel or a substantially fluid-tight roughing pump pressure vessel.

For the reasons cited above with regard to Claim 1 and Claim 17, Applicant believes that currently amended independent Claim 17 is patentable over Zhu in view of Silvon, and further in view of Chiang and is believed to be in condition for allowance.

Claims 17-23 are dependent upon Claim 17, and are therefore allowable as a matter of law.

Regarding independent Claim 42, for the reasons cited above with regard to Claims 1, 24, 34 and 17, Applicant believes that currently amended independent Claim 42 is patentable over Zhu, in view of Silvon, and further in view of Chiang and is believed to be in condition for allowance.

Claim 43-47 are dependent upon Claim 42, and are therefore allowable as a matter of law.

If the Office is not fully persuaded as to the merits of Applicant's position, or if an Examiner's Amendment would place the pending claims in condition for allowance, a telephone call to the undersigned at (727) 507-8558 is requested.

Very respectfully,

SMITH & HOPEN

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Dated: May 15, 2003

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CERTIFICATE OF FACSIMILE TRANSMISSION
(37 C.F.R. 1.8(a))

I HEREBY CERTIFY that this Amendment A is being transmitted by facsimile to the United States Patent and Trademark Office, Art Unit 2881, Attn.: Paul M. Gurzo, (703) 872-9318 on May 15, 2003.

Dated: May 15, 2003

Deborah Preza